APPARATUS CLAIMS

1. A variable impedance prosthesis or orthosis, comprising:

    a. A proximal end for interfacing to a user;

    b. a distal end for interfacing to the environment;

    c. a stiffness controller;

    d. a controllable-spring-rate spring element.

2. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises multiple parallel interlockable spring elements.

3. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises a spring element with a variable mechanical advantage.

4. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises multiple parallel valved pneumatic spring elements.

5. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises a spring element and a parallel powered mechanical force source.

6. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises a spring element and a series powered mechanical displacement source.

7. The apparatus of claim 1, wherein said controllable-spring-rate spring element further comprises:

    a. a first spring element disposed between said proximal end and said distal end;

    b. a mechanical energy storage element;

    c. a controllable power source configured to store energy in said energy storage element;

d. a controllable coupling between said energy storage element and said first spring element;

e. a controller configured to control timing and rate of power output of said controllable mechanical power source, and coupling of controllable coupling.

8. The apparatus of claim 7, wherein said controllable mechanical power source comprises a muscle and a controllable mechanical coupling between said muscle and said energy storage element

METHOD CLAIMS

9. A method for providing variable mechanical impedance in a prosthetic or orthotic, comprising varying the spring rate a controllable-spring-rate spring automatically with a spring-rate controller as a function of a repeated cycle of use of said prosthetic or orthotic.

10. The method of claim 9, wherein said variable-spring-rate spring comprises multiple parallel interlockable spring elements, and said controller controls the interlocking of said elements.

11. The method of claim 9, wherein said variable-spring-rate spring further comprises a first spring and an energy storage element, and further comprising:

a. storing energy from a power source in said energy storage element during a first span of time;

b. releasing energy from said energy storage element in the form of mechanical work displacing a proximal end of a prosthesis from a distal end of said prosthesis or orthosis during a second span of time.